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Europäisches Patentamt
European Patent Office
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(11) Publication number:

0 668 132 A1

(12)

EUROPEAN PATENT APPLICATION(21) Application number: **95101794.6**(51) Int. Cl.⁶: **B26D 7/18**(22) Date of filing: **09.02.95**

(30) Priority: **18.02.94 US 198763**
02.12.94 US 348724

(43) Date of publication of application:
23.08.95 Bulletin 95/34

(94) Designated Contracting States:
DE ES FR GB IT SE

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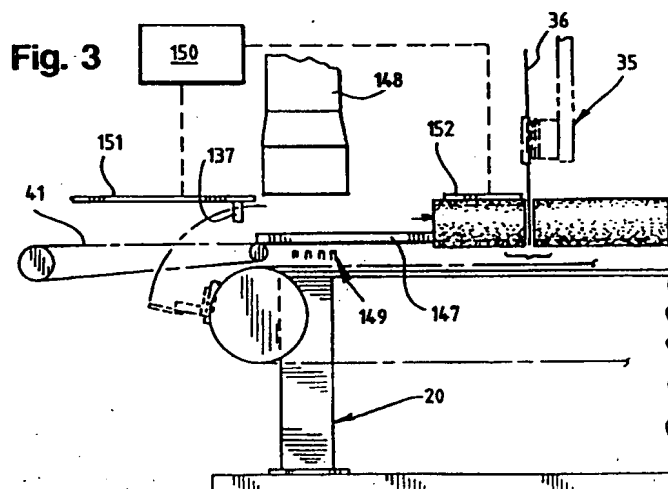
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(54) **Apparatus and method for removal of trim in a saw.**

(57) Apparatus and method for removal of trim in a saw for transversely severing elongated lengths of multi-ply web material wherein an air conducting removal tube (148) is employed to take the trim

pieces upwardly away from the conveyor which advances the trim through the transversely cutting saw (35).

**EP 0 668 132 A1**

BACKGROUND AND SUMMARY OF INVENTION:

This invention relates to a trim eliminator for a saw and method and, more particularly, to a trim eliminator for a saw which transversely severs multi-ply material such as logs of bathroom tissue and kitchen toweling and bolts of folded facial tissue and toweling.

A trim eliminator is intended to transport cut product from a saw conveyor, through the saw enclosure, and onto a conveyor system which eventually feeds some sort of packaging equipment. The saw conveyor is that which conveys the product through the cutting process. Typically, the log (rolled product) or bolt (folded product) has excess product (referred to as trim) at each end which is waste and must be discarded or recycled.

In the production of such consumable products as toilet tissue and kitchen toweling, jumbo sized parent rolls from a paper machine are transferred to a converting area where they are "rewound". The rewinding involves unwinding the parent rolls, usually transversely perforating the web therefrom, and then rewinding the web into a log having the diameter of a retail sized roll. Illustrative rewinders are co-owned U.S. Patents RE. 28,353 and 4,828,195 dealing respectively with the center winding type and the surface winding type of re-winder. The output of these machines normally is a log having a length equal to the width of the web being unwound from the parent roll.

Thereafter, this log is subjected to transverse cutting by a log saw so as to develop a plurality of retail sized rolls and two end trim annuli. Illustrative of a log saw is co-owned U.S. Patent RE. 30,598. The annuli at the log ends are necessarily present because the width of the sheet or web from the parent roll cannot be exactly an even multiple of the number of rolls to be derived therefrom. A certain amount of "trim" is always provided so as to make sure that the end rolls, i.e., the rolls from each side of the web, have clean, flat ends.

In like fashion, bolts as contrasted to logs, are made up of multi-ply web material. Exemplary of machines for interfolding are those shown and described in co-owned U.S. patents 3,195,882 and 3,572,681.

In any event, the trim pieces have been disposed of in a number of ways -- usually by supporting the roll or bolt piece and allowing the trim pieces to fall by gravity. For example, as the trim enters the area of the trim eliminator, it is not transported to the downstream conveying system. It is allowed to drop, thus eliminated. Once dropped, the trim must be removed from the saw enclosure by a separate means, such as a flat belt conveyor or a vacuum system. Some examples of present trim eliminator conveying systems are: me-

chanical gripper fingers -- positioned above the product as in co-owned U.S. patent 4,977,803; round belt conveyor -- below product; single or dual vacuum belt -- above product; and side compression pad, mounted on chain conveyor, and slide bar -- positioned on side of product.

The invention provides a method and apparatus for handling elongated lengths of multi-ply material and trim pieces resulting from transversely severing the elongated lengths to form shorter length products wherein each elongated length as well as the products therefrom has an upstream and a downstream end. And there are trim pieces at each end of each elongated length. Both the elongated lengths and then the shorter products are supportably advanced along a generally horizontally extending path with the invention including the steps of gripping and advancing the most upstream product of each elongated length while removing by generally upward movement the trim piece adjacent said most upstream product, and also removing by movement generally upwardly the trim piece adjacent the most downstream product. In one aspect of the invention, the removal steps are accomplished by applying an upwardly directed air blast below the trim pieces to move the trim pieces upwardly into a removal tube. Alternatively or cumulatively, the removal tube may be equipped with vacuum to develop or assist the upward movement of the trim pieces.

For gripping, i.e., blocking upward movement, of the product adjacent a trim piece, a carriage is provided for each end of the elongated length, i.e., over the most upstream product and most downstream product.

This carriage is positioned between the removal tube and the product to move with the product to ensure that it is not removed by the upward air flow. For example, one carriage is equipped with gripper means and accelerates to the speed of the product, grabs the last cut product and moves it away from the trailing trim and product pusher. As the carriage moves, it allows the air flow to remove the trailing trim from the product area.

Control of each carriage can be servo (motor, air, or hydraulic cylinder), mechanical means (cam and lever), air cylinder with proportional valve, stepper motor, etc. This invention is unique in that it combines the duties of the trim eliminator and trim removal systems. It provides a means to eliminate and remove the trim just after cutting while this product is still on the saw conveyor. This is compared to a transfer of the product to a trim eliminator in order to achieve trim elimination, then removal. The invention is simpler in that it does not handle each cut product -- only the first and last product of each log or bolt. This equates to less

product marking and less maintenance. The invention offers a means to provide quick change or pushbutton change for cutoff length, log diameter or bolt height, log or bolt length and trim length.

Other objects and advantages of the invention may be seen in the details of construction set down in the ensuing specification.

BRIEF DESCRIPTION OF DRAWING:

The invention is described in conjunction with the accompanying drawing, in which –

FIG. 1 is a side elevational view, essentially schematic, of a log saw of the prior art type;

FIG. 2 is a fragmentary perspective view of gripping members also according to the prior art;

FIG. 3 is a fragmentary side elevational view partly schematic of apparatus embodying teachings of the invention;

FIG. 4 is a graph plotting velocity against time for the sawhead, conveyor and gripper during removal of the trailing or upstream trim;

FIG. 5 is a view similar to FIG. 3 but relating to the start of a cycle of trim removal;

FIGS. 6-17 are views similar to FIG. 5 but showing the disposition of elements and product in subsequent stages of the cycle, i.e., "sequence" views;

FIG. 18 is a view similar to FIG. 3 in being a side elevation of the inventive apparatus but without schematic representations;

FIG. 19 is a sectional view such as would be seen along the sight-line 19-19 applied to FIG. 18; and

FIG. 20 is a top plan view of the apparatus of FIGS. 18 and 19.

DETAILED DESCRIPTION:

Prior Art

Referring to FIG. 1, the numeral 30 designates generally the frame of the saw apparatus. Starting from the right or upstream end, the numeral 31 designates generally the conveyor for the log or bolt to be transversely severed. The conveyor 31 conventionally has stationary side rails defining troughs for the product or work piece. These products are advanced along the horizontal path P (see the right hand portion of FIG. 1) by pushers 32 and 33 – see FIG. 2. This showing is taken from U.S. Patent 4,977,803 where the left hand showing (here pusher 32) was of the then prior art and the right hand showing was of the new pusher (here 33) first disclosed in the '803 patent. In this invention, the old style pushers 32 are employed.

Referring again to FIG. 1, the numeral 34 designates a saw enclosure for a high-speed, continuous motion saw generally designated 35 and featuring disc-type blades 36. Such a saw can be seen in previously-mentioned co-owned patent RE. 30,598. However, the invention is not limited to any particular type saw, only one that develops trim pieces from a longer log or bolt. For example, the invention is applicable to intermittent operation saws such as that shown and described in co-owned U.S. Patent No. 3,213,731.

In FIG. 1 downstream of the saw 35 are grippers 37 which also can be seen in FIG. 2. The grippers 37 are arranged in pairs as at 37a and 37b for each trough and are suspended from cross bars 38 advanced by a conveyor featuring spaced apart chains – one of which is designated 39 in FIG. 2.

Completing the prior art showing of FIG. 1, the numeral 40 designates generally a trim removal vacuum chute and the numeral 41 the downstream conveying system.

Completing the prior art showing of FIG. 2, the frame is seen fragmentarily as at 30 in FIG. 2 and the troughs at 42 and 43. Two troughs are normally employed so as to balance the transverse cutting forces. As indicated previously, also seen in FIG. 2 are roll pickers or grippers as at 37. These grip the roll after cutting to transport it horizontally to the takeaway conveyor 41. These grippers operate at the point where the endless pusher chain passes around the tail sprocket which, in FIG. 2 is masked by the guard 44. The tail sprocket is schematically represented as at 45 in FIG. 1.

The Invention

Instead of having the trim fall below the path P – and which requires a dump opening – the trim is air forced/drawn upwardly, so there is no need for an opening 46 (see the left hand portion of FIG. 1). Instead, trough defining rails continue as at 147 in FIG. 3. They extend into overlapping relation with the take-away conveyor 41. Upstream from the rails 147 in FIG. 3, the apparatus is generally the same as that depicted in FIG. 1. Thus, the saw is generally designated 35 and the disc blade 36. For ease of understanding, we have designated the elements that are new to the invention in the 100 series. For example, the grippers of this invention are designated 137 (see the left central portion of FIG. 3) as contrasted to the prior art grippers 37 as seen in FIG. 2.

Also what is different is the removal tube 148 which is supported on the frame 30 and air blast nozzles or jets generally designated 149 below the path P. Also different in the invention is a controller 150 which controls the position of carriage mechanisms 151, 152 which may perform a blocking

function relative to the removal tube 148. The controller also regulates the air blast 149 and, if present, any vacuum in the removal tube 148. So, broadly speaking, there are three modes of operation: use of jets alone, use of jets plus vacuum, and vacuum alone.

When there is suitable control of the vacuum, meaning it can be turned on and off at the appropriate time, the downstream carriage 151 is not needed. But, grippers 137 are still needed to move the product, adjacent to the trim, away from the trim and pusher. If this is not done, the product will squeeze the trim against the pusher not allowing the vacuum to lift it away.

If the vacuum is always on, then the downstream carriage 151 is needed to restrain product from being lifted away. The upstream carriage 152 is needed to restrain the most downstream product even if the vacuum is controlled. This is because the vacuum must remain on long enough to ensure that the trim has been removed from the saw area. It is this additional time which allows the most downstream product to come under the influence of the vacuum.

Operational Sequence for Removal of Trim

Here reference is first made to the graph or chart of FIG. 4. There, the numeral 153 designates the sawhead velocity profile. Because two blades 36 are employed, the profile is a rectified sine wave. However, only the relatively flat crest of the sine wave characterizes the blade movement during cutting. The numeral 154 designates the start of the cut and the numeral 155 the end of the cut.

The numeral 156 designates the conveyor velocity profile which is a straight line, i.e., constant. The other line 157 represents the gripper velocity profile — which is a speed higher than either the sawhead or conveyor velocity.

Reference is now made to FIG. 5 which represents the condition of machine elements and product at the beginning of a trim disposal cycle. Here we define a cycle as starting with the trailing end annulus and finishing with the leading end annulus of the next log or elongated length of multi-ply web material.

Here the trailing trim carriage 151 begins to accelerate to match the velocity of the infeed conveyor 31. The air blast 149 is "off" and the leading trim carriage 152 is in its "DWELL" state. Here, the product to the left is still being advanced by the pusher 42 — but at a speed lower than that of the takeaway conveyor 41.

Now referring to FIG. 6, the trailing trim carriage 151 has matched the speed of conveyor 31 and the gripper mechanism 137 pivots to its "grip" position to accelerate the product to the speed of

conveyor 41. In the illustrated embodiment, the time lapse between the showings of FIGS. 5 and 6 is fifty milliseconds.

Reference is now made to FIG. 7 which is the showing of approximately one hundred fifty milliseconds after that of FIG. 5, i.e., one hundred fifty milliseconds into its cycle. In FIG. 7, the trailing trim carriage 151 is now at the velocity of the takeaway conveyor 41 and is starting to uncover the inlet to the removal tube 148 which may apply some suction to the product (if suction is employed), particularly the trailing trim T_T which is being advanced by the pusher 42.

In FIG. 8, which is approximately three hundred fifty milliseconds from start, the conditions are as in FIG. 7 except for further advance of product and trim and the turning on of the air blast 149. By this time, the opening at the bottom of the removal tube 148 is substantially uncovered. At four hundred fifty milliseconds (FIG. 9), the trailing trim T_T is now well into the air tube 148. Also, at this time the leading trim carriage 152 begins its acceleration to slightly exceed the speed of the infeed conveyor 31.

Referring now to FIG. 10 (five hundred fifty milliseconds), the trailing trim carriage 151 is seen in its forward DWELL position, having stopped and is about to accelerate rearwardly to return the upstream end of the carriage 151 to the forward edge of the removal tube 148 — this condition being seen in FIG. 11 (six hundred fifty milliseconds and designated DWELL POSITION 2). Meanwhile the leading trim carriage 152 has reached its maximum velocity of slightly higher than that of the infeed conveyor 31. The air blast 149 is still on and the grippers 137 of the leading trim carriage 152 have pivoted to the grip position — see FIG. 10.

In FIG. 12 (seven hundred fifty milliseconds), the leading trim T_L is beginning to enter the removal tube 148 and in FIG. 13 (eight hundred fifty milliseconds) the trailing trim carriage 151 starts accelerating to return to its first DWELL position.

In FIG. 14 (nine hundred fifty milliseconds), the trailing trim carriage 151 is at DWELL, the air blast 149 is on and the leading trim carriage 152 is at maximum velocity (slightly faster than the velocity of the infeed conveyor 31). In FIG. 15, (one thousand milliseconds, i.e., one second), the trailing trim carriage 151 is still at DWELL. The leading trim carriage 152 now is at its maximum velocity which is slightly faster than the velocity of the infeed conveyor 31. In FIG. 16 (one thousand one hundred milliseconds), the trailing trim carriage 151 is still at DWELL, the air blast is now off and the leading trim carriage 152 is at its maximum velocity which is slightly faster than that of the infeed conveyor. Lastly, in FIG. 17 (one thousand, one hundred fifty milliseconds), the trailing trim carriage 151 is still at DWELL. Now the leading trim car-

riage 152 begins to decelerate and the gripper 137' is pivoted off of the product. The trailing trim carriage 151 and leading trim carriage 153 now move together to the position shown in FIG. 5 in order to begin the next trim disposal cycle.

Structural Features

Reference is now made to FIG. 20 where the numeral 148 is in the center of the view and again designates the removal tube, i.e., the tube which draws the annuli away from the rails 147 (see the central part of FIG. 3). When the annuli are moved by the air blast 149, they can be delivered to a receptacle for repulping or other disposition. When vacuum is used, a separator such as a cyclone is normally interposed between the tube 148 and the receiver. Flanking the tube 148 in FIG. 20 are the trailing trim carriage 151 and the leading trim carriage 152. These carriages each are generally rectangular and at the four corners are equipped with guide wheels as at 158 relative to the carriage 151 and 159 relative to the carriage 152 (designated only in the lower left hand corners of each). The guide wheels 158 can be seen in FIG. 19 and are entrained on tracks as at 160 — also designated in FIGS. 18 and 20.

Now referring to FIG. 20 it will be seen that each of the carriages 151 and 152 is equipped with its own rotary actuator 161 and 162, respectively, for pivoting the grippers 137 and 137' into the raised and lowered positions. For example, the raised position of the grippers 137 is seen in FIG. 5 and the lowered position in FIG. 6. Correspondingly the raised position of the grippers 137' is seen in FIG. 9 and the lowered position in FIG. 10.

The rotary actuator can also be seen in the central portion of FIG. 19. A suitable device for this purpose can be obtained from Parker Fluid Power Co. located in Wadsworth, Ohio under product designation Rotary Actuator Model PV33D. The actuator has extended shafts as at 163 — still referring to FIG. 19 which carries an arm 164 and to which is affixed a resilient gripper element 165. This element 165 may be of a soft, compressible foam which enables the element to conform to the contour of the shorter length product, i.e., bathroom tissue roll, interfolded facial tissue, etc.

Still referring to FIG. 19, there is a subframe generally designated 166 which carries the tracks 160 and therefore the carriages 151, 152. The subframe can be raised or lowered relative to the infeed conveyor generally designated 31 (see the lower central portion of FIG. 19) for changes in product, diameter and height. The subframe 166 is coupled to stepper motor means 167 — see the upper central portion of FIG. 19 and also the upper left portion of FIG. 18. The upstream and down-

stream ends of the subframe 166 are stabilized by the bar and linkage assembly generally designated 168 and best seen in FIG. 18 in the upper portion of the view and extending from the left to the right end. The bar is designated 169 and the linkages 170 — one at each end of the bar 169.

To move the carriages 151, 152 horizontally and follow the velocity profile in FIG. 4, we provide servo motors 171 and

Claims

1. A method for handling elongated lengths of multi-ply material and trim pieces comprising the steps of transversely severing said elongated lengths to form shorter length products wherein each said elongated length and product has an upstream and a downstream end, trim pieces at each end of each elongated length, supportably advancing each said elongated length and product along a horizontally extending path (P) characterized by gripping (137) and advancing (151) the most upstream product of each elongated length while removing by generally upwardly movement (149) the trim piece (T₁) adjacent said most upstream product, and also removing by movement (149) generally upwardly the trim piece (T₂) adjacent the most downstream product.
2. The method of claim 1 in which said steps include applying an upwardly-directed air blast (149) below said trim pieces.
3. The method of claim 1 in which said steps include applying a vacuum above said trim pieces.
4. The method of claim 3 in which said steps include applying an upwardly directed air blast (149) below said trim pieces when said trim pieces are subject to said vacuum.
5. The method of claim 1 in which the step of gripping and advancing said most upstream product includes advancing the same at a speed (157) greater than the speed of advance (156) of said elongated lengths.
6. The method of claim 1 in which said steps include providing a removal tube above said path and an air blast means below said path generally aligned with said tube and carriage means movable into closing relation with said removal tube, and positioning said carriage means over the products adjacent each trim piece whereby said adjacent products are prevented from moving generally upwardly under

- the influence of said air blast means.
7. The method of claim 1 in which said elongated lengths are logs of convolutely wound material and said shorter lengths are retail size rolls. 5
 8. The method of claim 1 in which said elongated lengths are bolts of folded web material.
 9. The method of claim 1 for handling logs or bolt of multi-ply material and trim pieces resulting from transversely severing said logs or bolts into shorter length products in which the steps of removing by movement generally upwardly the trim adjacent said most upstream product and also removing by movement generally upwardly the trim piece adjacent the most downstream product of each bolt or log, are accompanied by the steps of restraining against upward movement products adjacent said trim pieces whereby said products are not moved out of said path during trim removal. 10 15 20
 10. The method of claim 9 in which said steps include providing a vacuum above said path and an air blast aligned with said vacuum below said path. 25
 11. Apparatus for handling elongated lengths of multi-ply material and trim pieces resulting from transversely severing said elongated lengths to form shorter length products wherein each said elongated length and product has an upstream end and a downstream end, said elongated lengths and products being supportably advanced along a horizontally-extending path also having upstream and downstream ends comprising a frame, trough means (42) on said frame defining in part said horizontal path (P), pusher means (32) operably associated with said trough means for engaging the upstream end of an elongated length to advance each said elongated length toward the downstream end of said path, blade means (36) movably mounted on said frame for transversely severing each elongated length into a plurality of products and upstream and downstream trim pieces, characterized by gripper-equipped carriage means (151, 152) for said products movably mounted on said frame above said path and adjacent the downstream end of said trough means for gripping the product adjacent each trim piece, air flow means (148, 149) associated with said gripper means, and 30 35 40 45 50 55
control means (150) for selectively actuating said air flow means to move upwardly the trim pieces adjacent said adjacent products.
 12. The apparatus of claim 11 in which said air flow means includes a removal tube (148) having a trim receiving end and a product trim discharge end, and trim disposal means at said discharge end.
 13. The apparatus of claim 11 in which said frame is equipped with air jet means (149) below said path (P) for directing air upwardly, said control means being operatively associated with said air jet means to coordinate operation of said air jet means with said trim pieces.

Fig. 1
Prior Art

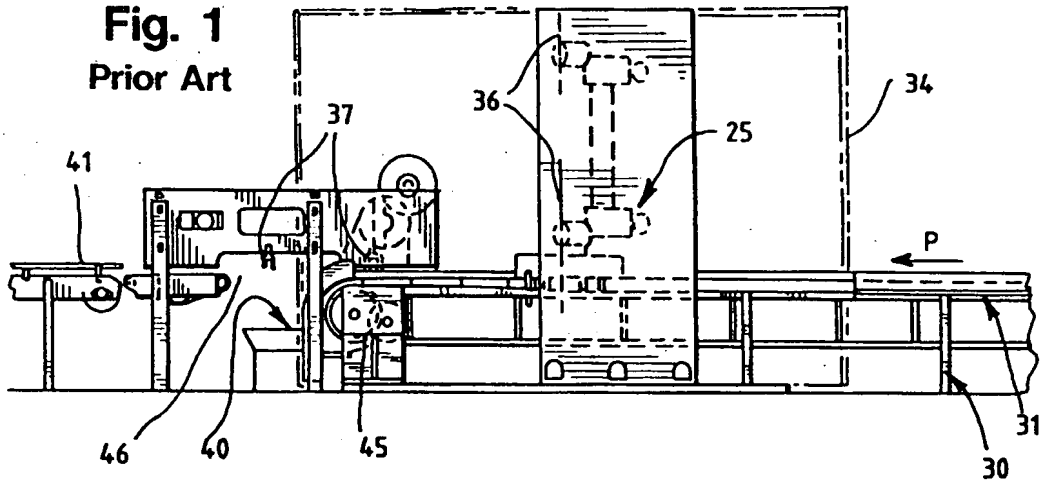
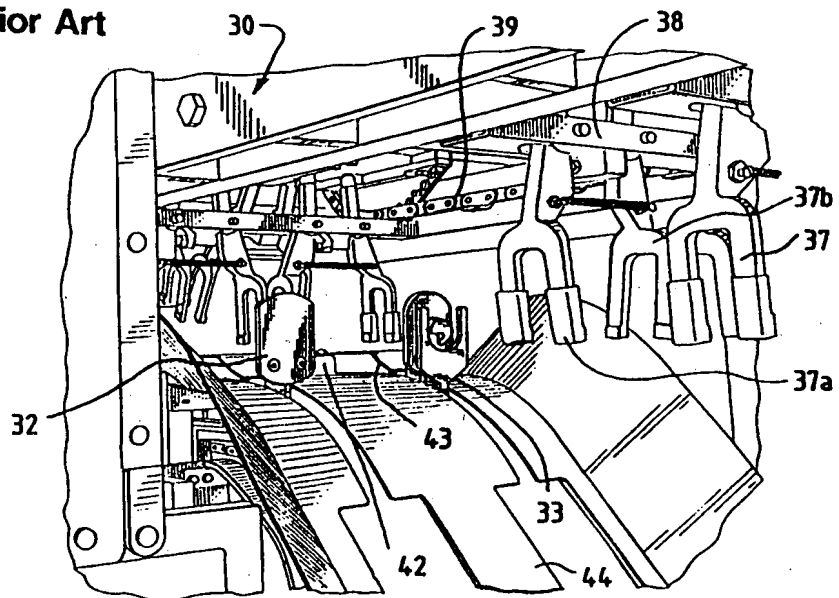
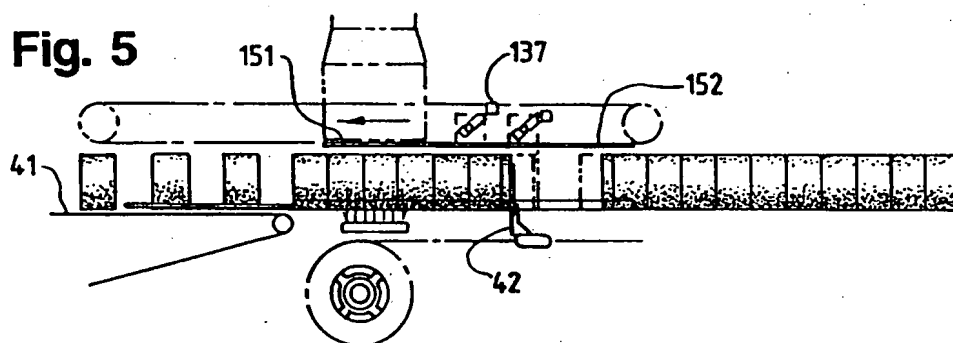
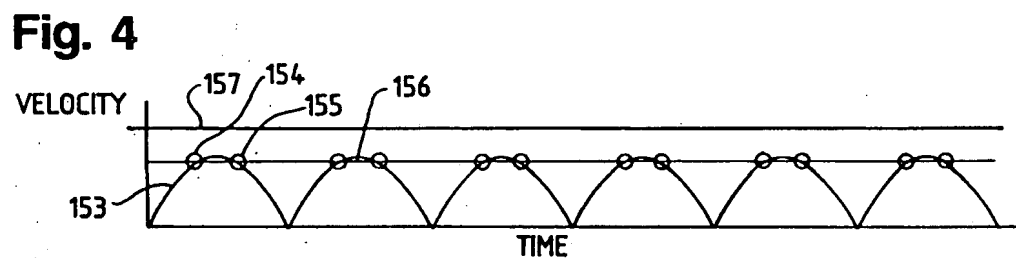
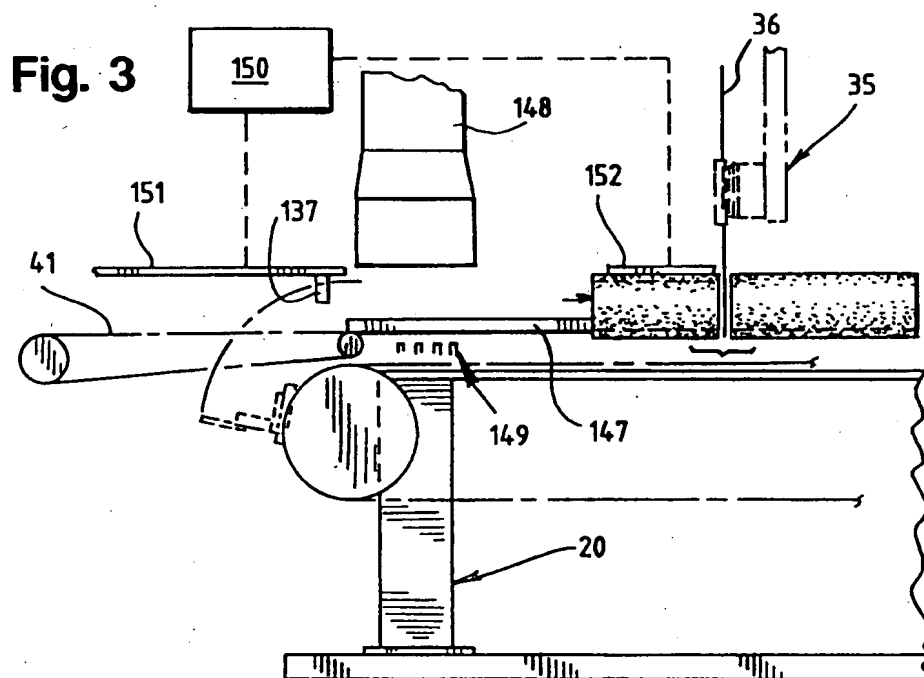


Fig. 2
Prior Art





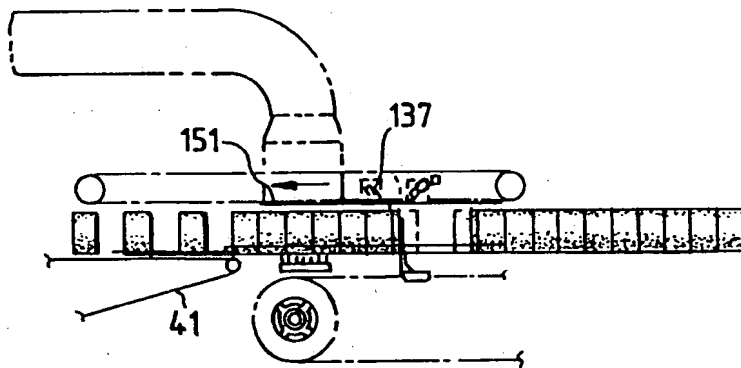


Fig. 6

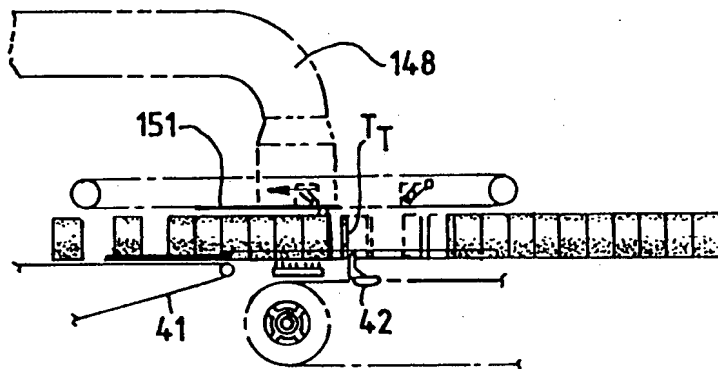


Fig. 7

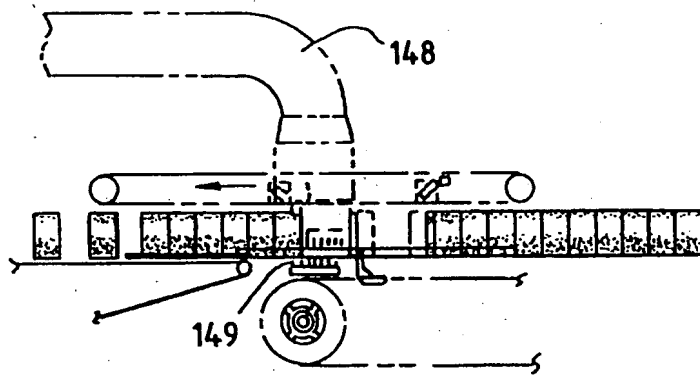


Fig. 8

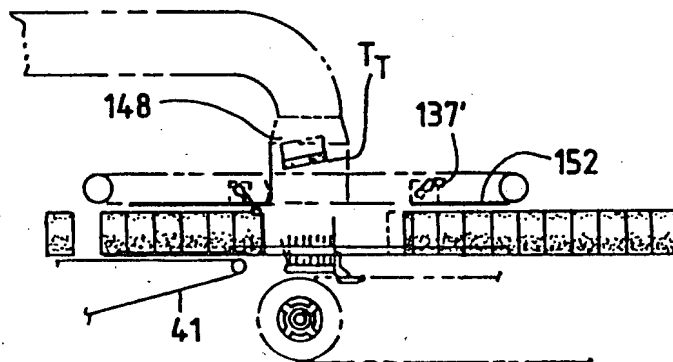


Fig. 9

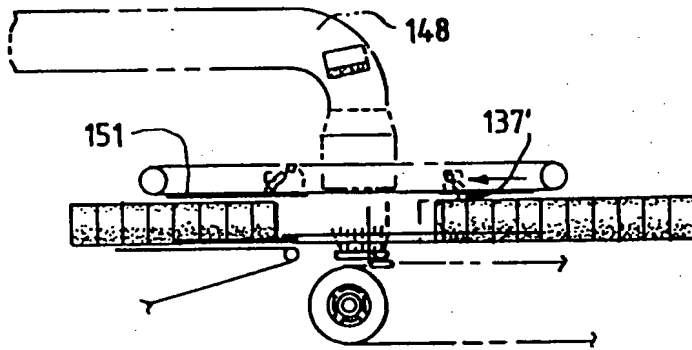


Fig. 10

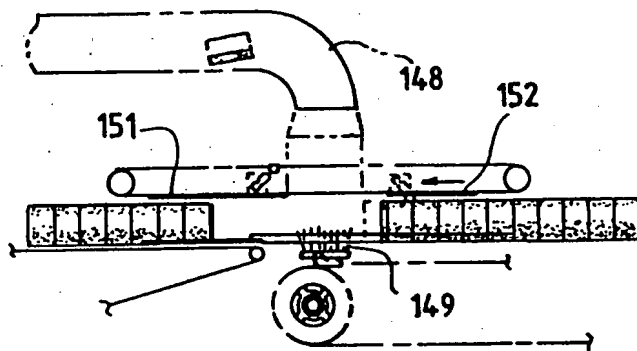


Fig. 11

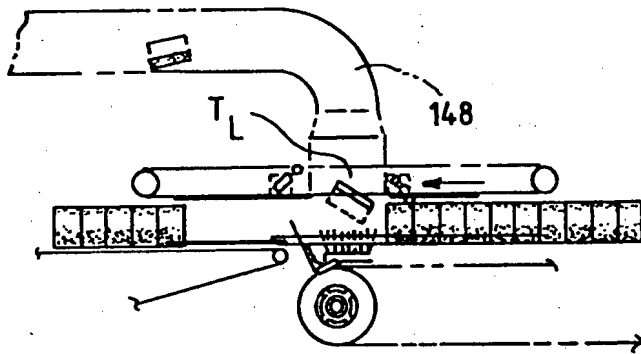


Fig. 12

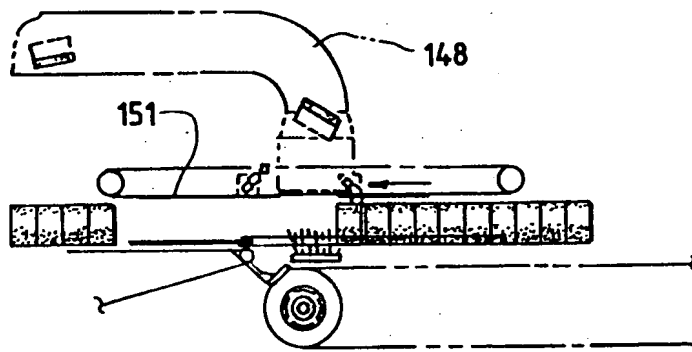


Fig. 13

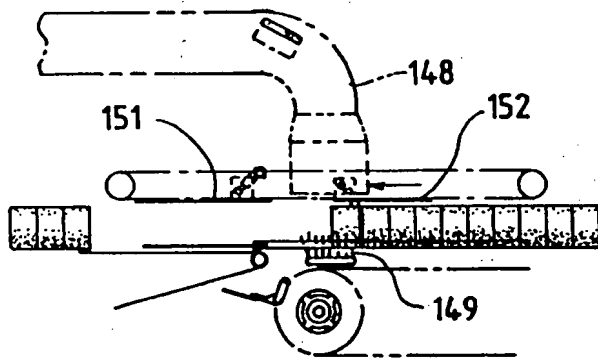


Fig. 14

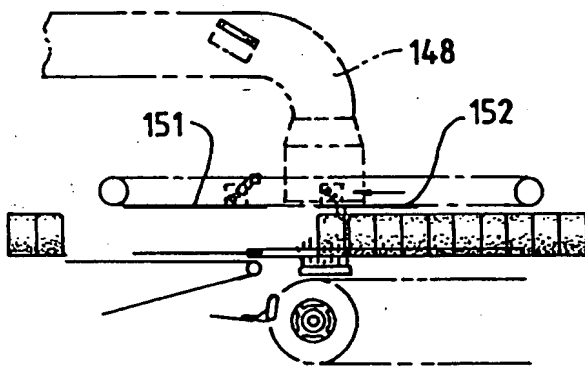


Fig. 15

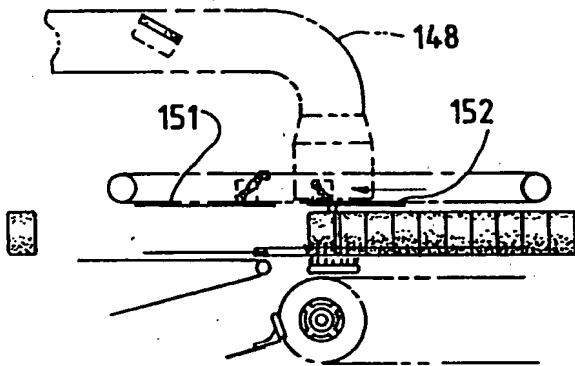


Fig. 16

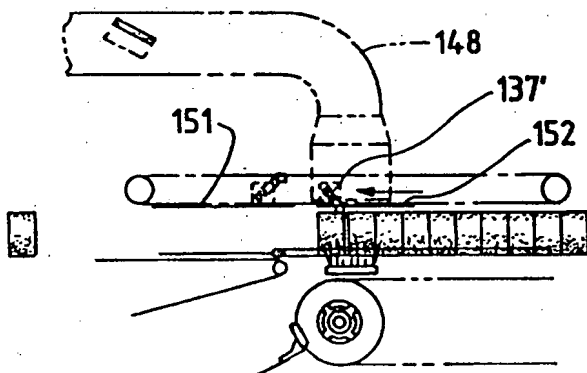


Fig. 17

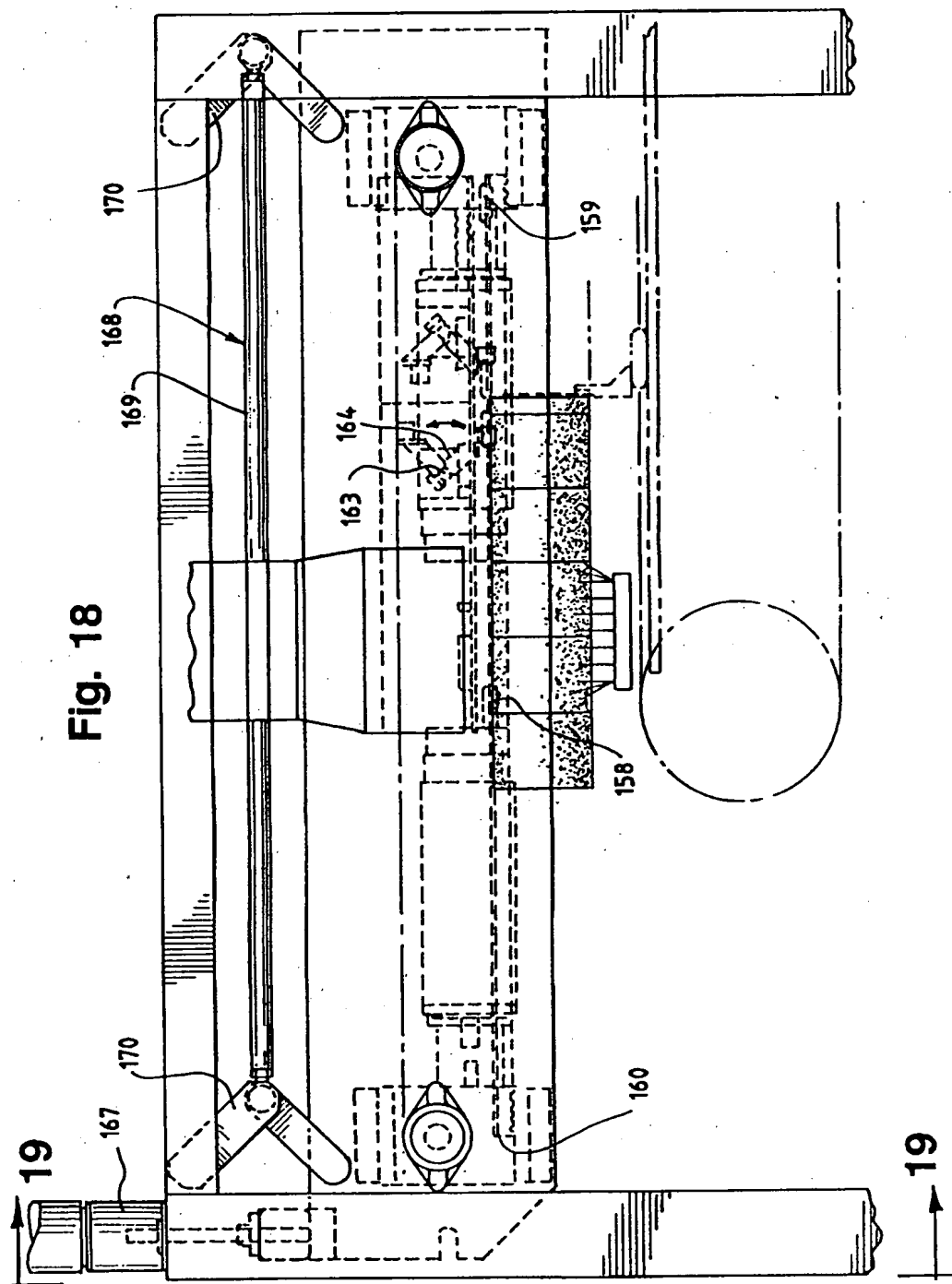


Fig. 19

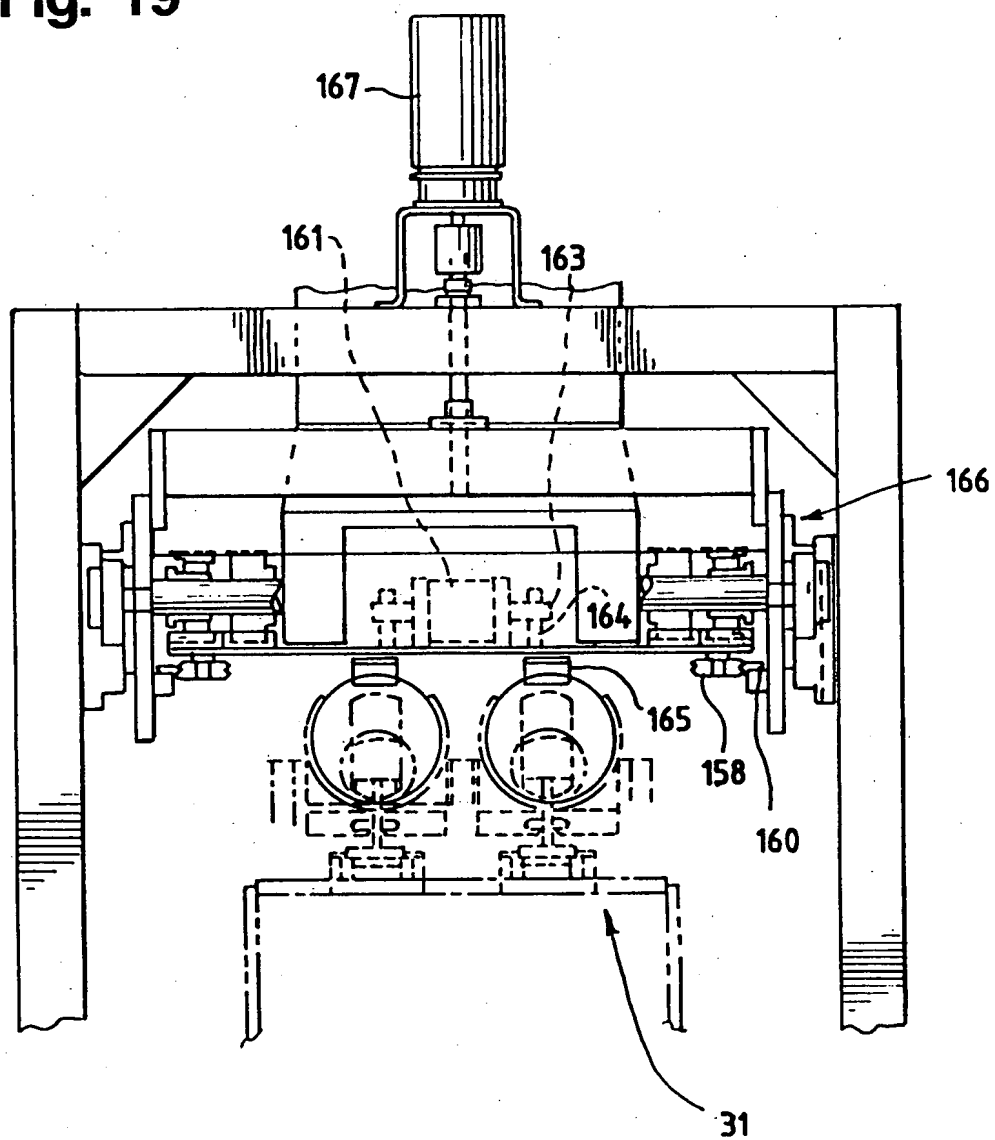
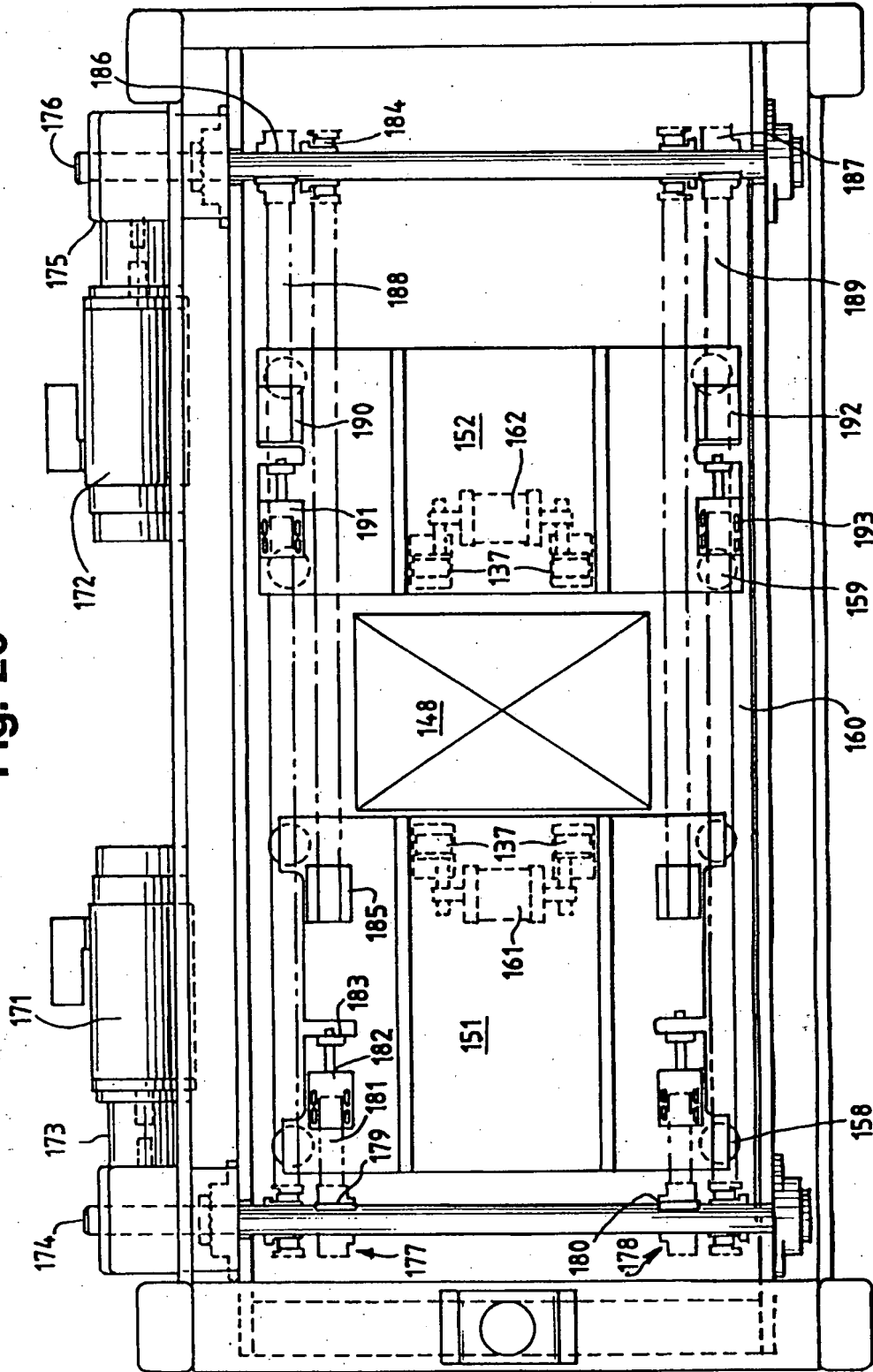


Fig. 20





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 1794

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
P,X	EP-A-0 607 761 (FABIO PERINI S.P.A) * the whole document *	1,5-7,9,11	B26D7/18
X Y A	FR-A-1 304 864 (R-C CAN COMPANY) * page 7, right column, paragraph 1 *	1,2 3,4 11,13	
X	FR-A-2 164 382 (SKANDINAVISKA APPARATINDUSTRI AKTIEBOLAGET SAIAP) * page 6, line 1 - line 6; figure 5 *	1	
X	DE-A-42 04 756 (WUSTENBERG) * abstract; figures *	1,9	
Y	EP-A-0 468 254 (HEILDERBERGER DRUCKMASCHINEN AG) * page 4, line 17 - line 37 *	3,4	
A	PATENT ABSTRACTS OF JAPAN vol. 18 no. 217 (M-1594), 19 April 1994 & JP-A-06 015599 (KAWANOE ZOKI KK) 25 January 1994, * abstract *	5	TECHNICAL FIELDS SEARCHED (Int.Cl.6) B26D
A	US-A-4 362 461 (CATHERS)	6	
A	US-A-2 020 113 (FERGUSON) * page 3, line 41 - line 56 *	12	
A	GB-A-2 137 918 (FINANZIARIA LUCCHESI S.P.A.)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 31 May 1995	Examiner Vaglianti, G
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons A: member of the same patent family, corresponding document			